



ARJUNA NEET BATCH



TRIGONOMETRY

LECTURE - 01

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PhD in Physics

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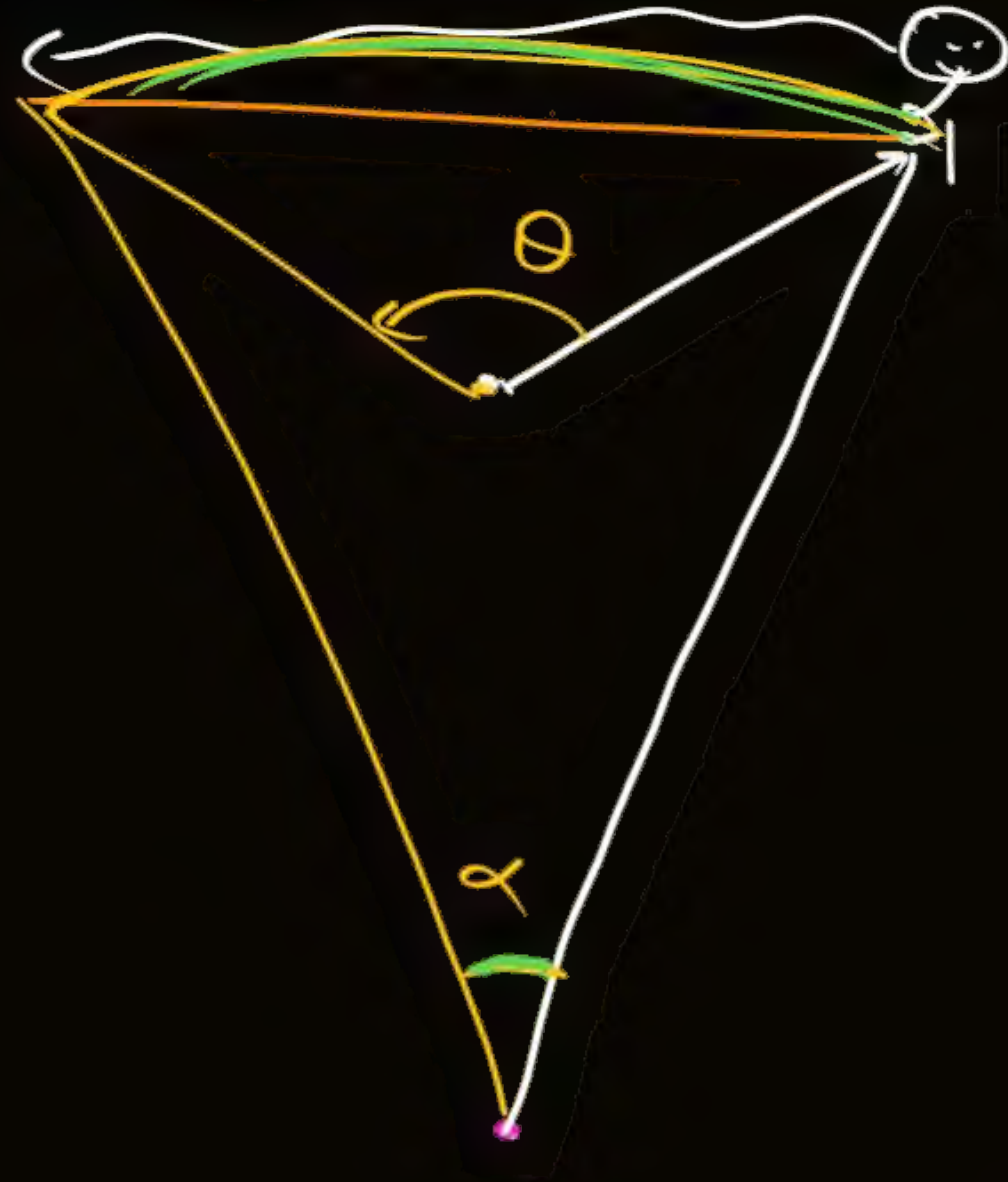
EXP - 8 years

- Shresth Vashistha
AIR-27 [NEET-17]
- Vaxun Nandakumar
AIIMS-42
- Rishabh Vaishnav
AIR-71 NEET-19

TODAY'S GOAL

- ❖ **Basic Concept of Trigonometry**
- ❖ **Basic algebra ✓**
- ❖ **Binominal Theorem ✓**
- ❖ **G/P Series ✓**

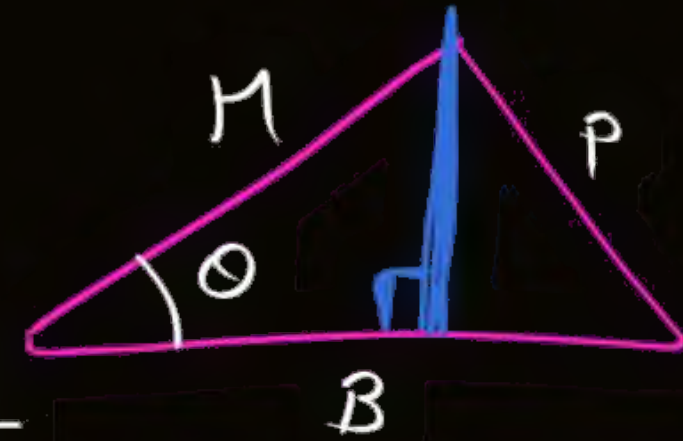




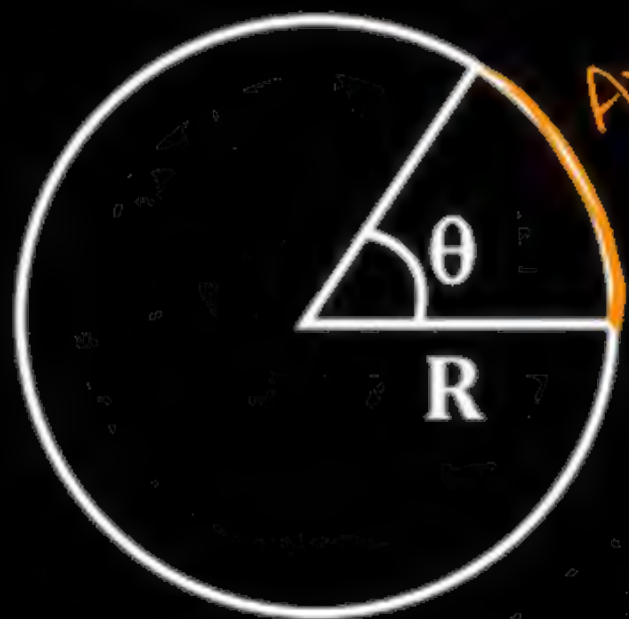
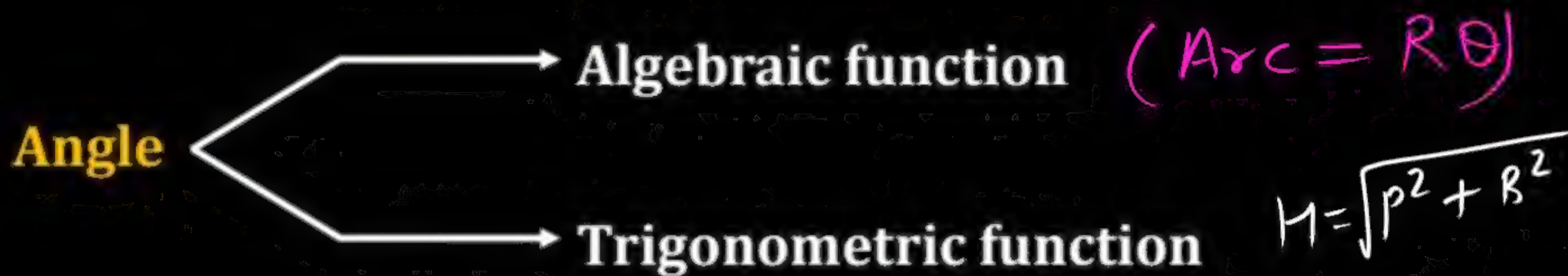
Angle α $\frac{\arccos}{R}$

Angle $(\theta) = \frac{\arccos}{R}$

$\sin \theta = \frac{P}{H}$



ANGLE



$$\frac{Arc}{R} = \theta$$

$$Arc = R\theta$$

S.I unit (rad)



$$\sin \theta = \frac{P}{H}$$

$$\cos \theta = \frac{B}{H}$$

$$\tan \theta = \frac{P}{B}$$



$$\sin \theta = \frac{P}{H}$$

$$\cos \theta = \frac{B}{H}$$

$$\tan \theta = \frac{P}{B}$$

$$\operatorname{cosec} \theta = \frac{H}{P}$$

$$\sec \theta = \frac{H}{B}$$

$$\cot \theta = \frac{B}{P}$$

Unit
128

UNIT OF ANGLE



Rad (S.I. Unit)

Degree

min/sec

(For small angle)

$$y = \theta$$

Unit of Angle (θ)
must be in rad.

for Trigonometric
function

$$\sin \theta$$

Angle
may be
in rad/degree

$$1^\circ = 60' (\text{min})$$

$$360^\circ = 2\pi \text{ rad}$$

$$180^\circ = \pi \text{ rad}$$

$$1^\circ = \frac{\pi \text{ rad}}{180}$$

$$1 \text{ rad} = \frac{180^\circ}{\pi}$$

$$1' = \frac{1^\circ}{60}$$

$$y = \theta = 30^\circ$$



$360^\circ = 2\pi \text{ rad}$ \rightarrow S.I unit of Angle

$$180^\circ = \pi \text{ rad}$$

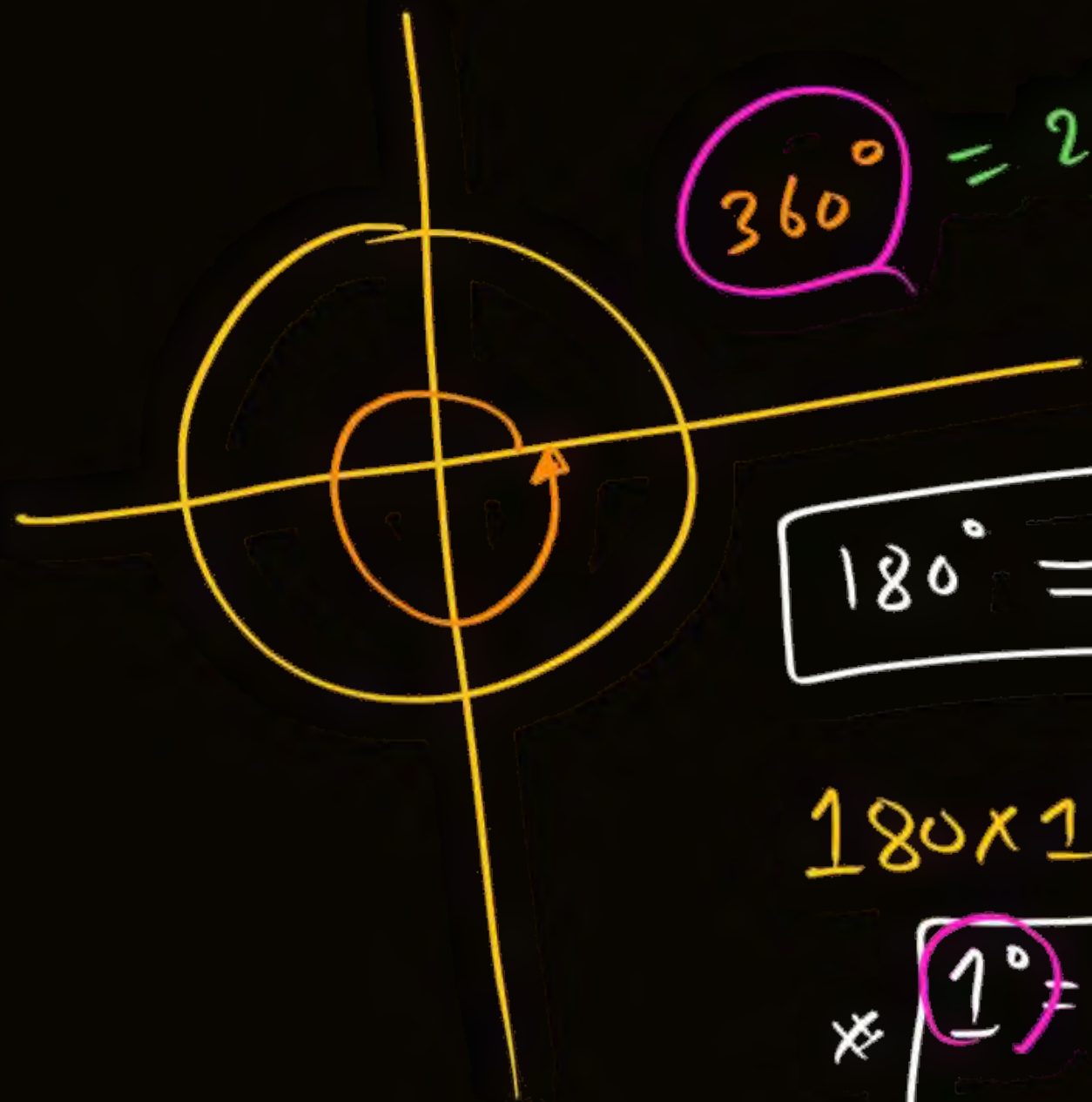
$$180 \times 1^\circ = \pi \text{ rad}$$

$$* 1^\circ = \frac{\pi \text{ rad}}{180}$$

$$1 \text{ m} = 100 \text{ cm}$$

$$1 \text{ km} = 1000 \text{ m}$$

$$1 \text{ rad} = \frac{180^\circ}{\pi}$$



Convert angle from rad to degree.



(i) $\frac{\pi}{2}$ rad

(ii) $\frac{\pi}{4}$ rad

(iii) $\frac{\pi}{3}$ rad

(iv) $\frac{5\pi}{6}$ rad

(v) $\frac{2\pi}{3}$ rad

(vi) $\frac{4\pi}{3}$ rad = 240°

$\pi \text{ rad} = 180^\circ$

(i) $\frac{\pi}{2} \text{ rad} = \frac{180^\circ}{2} = 90^\circ$

(ii) $\frac{\pi}{4} \text{ rad} = \frac{180^\circ}{4} = 45^\circ$

(iii) $\frac{\pi}{3} \text{ rad} = \frac{180^\circ}{3} = 60^\circ$

(iv) $\frac{5\pi}{6} \text{ rad}$

$= \frac{5}{6} \times 180^\circ = 150^\circ$

(v) $\frac{2\pi}{3} \text{ rad} = \frac{2}{3} \times 180^\circ = \underline{\underline{120^\circ}}$



Convert Angle from degree to rad

$$(i) 30^\circ = 30 \times 1^\circ = \cancel{30} \times \frac{\pi \text{ rad}}{\cancel{180} 6} \text{ (MADARI)}$$

→ MR*

$$30^\circ \times \frac{\pi \text{ rad}}{\cancel{180} 6}$$

$$(ii) 180^\circ = \pi \text{ rad}$$

$$(iii) \cancel{60}^\circ \times \frac{\pi \text{ rad}}{\cancel{180} 3} = \frac{\pi}{3} \text{ rad} = 60^\circ$$

$$(iv) 90^\circ = \cancel{90}^\circ \times \frac{\pi \text{ rad}}{\cancel{180} 2} = \frac{\pi}{2} \text{ rad}$$

$$(iv) 240^\circ = \cancel{240}^\circ \times \frac{\pi \text{ rad}}{\cancel{180} 3} = \frac{4\pi}{3}$$

$$(v) 45^\circ = \cancel{45}^\circ \times \frac{\pi \text{ rad}}{\cancel{180} 4}$$

$$(vi) 135^\circ = \cancel{135}^\circ \times \frac{\pi \text{ rad}}{\cancel{180} 4} = \frac{3\pi}{4}$$

$$(vii) 150^\circ =$$

If θ increases from 0° to 90°
then $\sin \theta \uparrow$

If $\theta \uparrow$ from 0° to 90°
then $\cos \theta \downarrow$



	0°	30°	45°	60°	90°	120°	135°	150°	180°
$\sin \theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{\sqrt{3}}{2}$	-1
$\tan \theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0

$$-1 \leq \sin \theta \leq 1$$

$$-1 \leq \cos \theta \leq 1$$

$$-\infty \leq \tan \theta \leq \infty$$

$$\tan \theta = \frac{\sin \theta \uparrow}{\cos \theta \downarrow}$$

MR*



If $\tan \theta = 2$ then find $\sin \theta$ and $\cos \theta$.



$$\tan \theta = \frac{2}{1} = \frac{P}{B}$$

$$\frac{P}{B} = \frac{2}{1}$$

if $P=2$
then $B=1$

$$H = \sqrt{P^2 + B^2}$$

$$H = \sqrt{5}$$

$$\sin \theta = \frac{P}{H} = \frac{2}{\sqrt{5}}$$

$$\cos \theta = \frac{B}{H} = \frac{1}{\sqrt{5}}$$



Q If $\sin \theta = 2$ then find $\tan \theta = ?$

Not Possible

Find $\tan \theta$

for any

$$-1 \leq \sin \theta \leq 1$$

oscillate
b/w -1 to $+1$

$$-1 \leq \cos \theta \leq +1$$

$$-\infty < \tan \theta < +\infty$$

If $\sin \theta = 3/5$ then find $\cos \theta$, $\tan \theta$.



9f

$$\sin \theta = \frac{3}{5}$$

Solⁿ

$$\sin \theta = \frac{p}{h} = \frac{3}{5}$$

9f $p = 3$ ✓

then $h = 5$ ✓

$$h^2 = p^2 + b^2$$
$$b^2 = h^2 - p^2$$
$$b = \sqrt{25 - 9}$$

$$b = 4 \quad \checkmark$$



Find :



$$P = 3$$

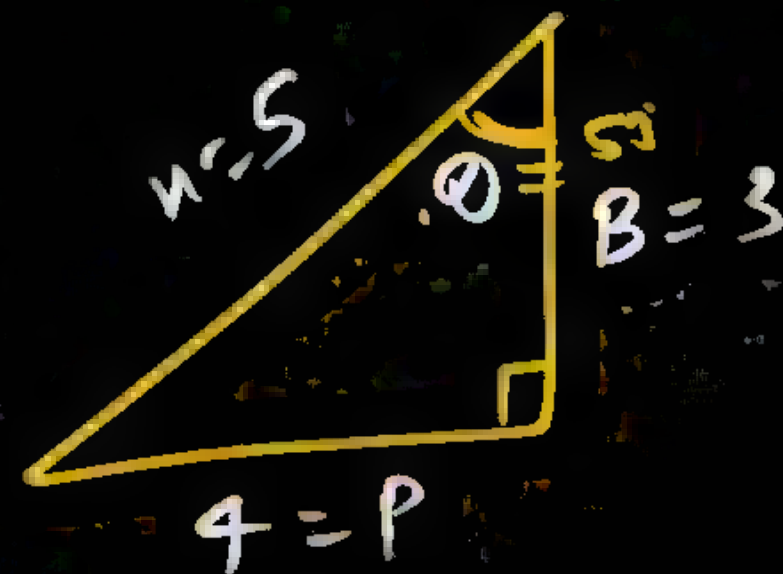
$$B = 4$$

$$\tan 37^\circ = \frac{3}{4} = \frac{P}{B}$$

$$\sin 37^\circ = \frac{3}{5}$$

$$\cos 37^\circ = \frac{4}{5}$$

$$H = 5$$



$$\tan 53^\circ = \frac{4}{3}$$

*

$$\sin 53^\circ = \frac{4}{5}$$

$$\cos 53^\circ = \frac{3}{5}$$

$$H = 5$$



If $y = \frac{\sin \theta}{\theta}$ then find value of y if $\theta = 30^\circ$.



$$y = \frac{(\sin \theta)}{\theta} = \frac{\sin 30}{30}$$

$$y = \frac{\sin 30}{\left(\frac{\pi}{6}\right)} = \frac{1}{\frac{2\pi}{6}} = \frac{3}{\pi}$$



SMALL ANGLE APPROXIMATION



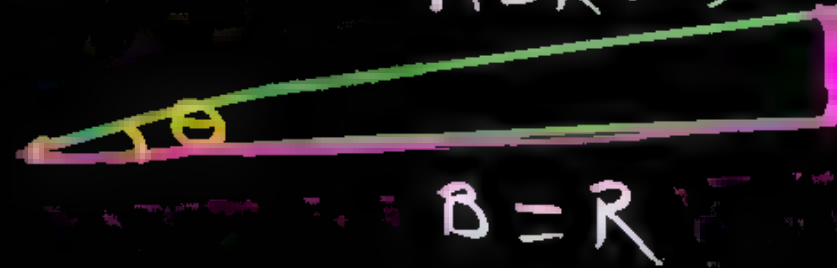
θ is very small

$$\sin \theta = \frac{P}{H} = \frac{R\theta}{R}$$

$$H = \sqrt{P^2 + B^2}$$

$$H = B$$

$$H = R (\text{let})$$



$$P = R\theta = R\theta$$

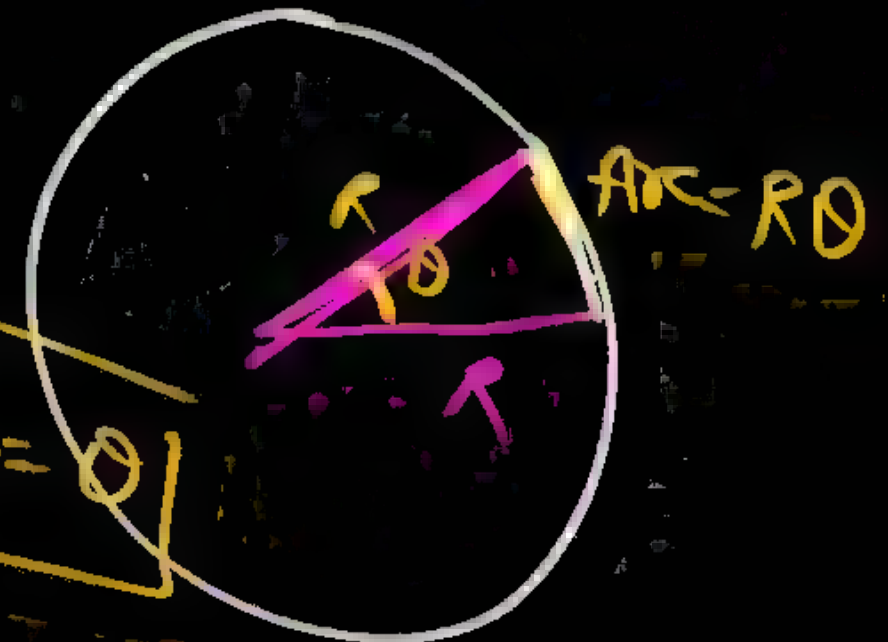
If θ is very small

$$\sin \theta = \theta$$

$$\cos \theta = \frac{B}{H} = \frac{R}{R} = 1$$

θ is small

$$\sin \theta = \frac{R\theta}{R} = \theta$$



$$|\tan \theta| = \frac{\sin \theta}{\cos \theta} = \frac{\theta}{1}$$

Small
Angle

$$\theta = 1^\circ \text{ to } 5^\circ$$

$$\tan \theta = \theta = \sin \theta$$

↳ for small angle

Find value :

- (i) $\sin 2^\circ$ (ii) $\tan 3^\circ = 3^\circ \frac{\pi \text{ rad}}{180} = \frac{\pi}{60}$ (iii) $\cos 3^\circ = 1$
 (iv) $\sin (88.5^\circ) = 1$ (v) $\sin (89^\circ) = 1$

Soln

$$\sin \theta = 0 = \tan \theta$$

$$\cos \theta = 1$$

$$\sin 2 = 2^\circ$$

$$\sin 2^\circ = 2^\circ \times \frac{\pi}{180} = \frac{\pi}{90}$$

$$\sin 2^\circ = \frac{\pi}{90}$$



$$(P^2 + B^2 = H^2)$$

If divided by P^2 both side.



$$P^2 + B^2 = H^2$$

divided by H^2 on both side

$$\left(\frac{P^2}{H^2}\right) + \frac{B^2}{H^2} = 1$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

QED

$$P^2 + B^2 = H^2$$

divided by P^2

$$1 + \left(\frac{B}{P}\right)^2 = \left(\frac{H}{P}\right)^2$$

$$1 + \cot^2 \theta = \sec^2 \theta$$



$$\sin \theta = \frac{P}{H}$$

$$\operatorname{Cosec} \theta = \frac{H}{P}$$

$$\cos \theta = \frac{B}{H}$$

$$\sec \theta = \frac{H}{B}$$

$$\tan \theta = \frac{P}{B}$$

$$\cot \theta = \frac{B}{P}$$

Find value :

- (i) $\sin(A+B) =$ (ii) $\sin(A-B) =$ (iii) $\cos(A+B) =$
 (iv) $\cos(A-B) =$ (v) $\tan(A+B) =$

$$\sin(A+B) = \sin A \cos B + \sin B \cos A$$

→ Right

$$\sin(A-B) = \sin A \cos B - \sin B \cos A$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\begin{aligned} \tan(A+B) &= \frac{\tan A + \tan B}{1 - \tan A \tan B} \end{aligned}$$



If $A = B$ then $\sin(A + A) =$



IF $A = B = \theta$

$$\sin(2\theta) = \sin\theta \cdot \cos\theta + \sin\theta \cdot \cos\theta$$

$$\sin(2\theta) = 2 \sin\theta \cdot \cos\theta$$

$$\cos(A + B) = \cos A \cdot \cos B - \sin A \cdot \sin B$$

$$\# \cos(2\theta) = \cos^2\theta - \sin^2\theta$$



Find value of :

(i) $\sin(75^\circ)$

(ii) $\sin(105^\circ)$

(iii) $\cos(120^\circ)$

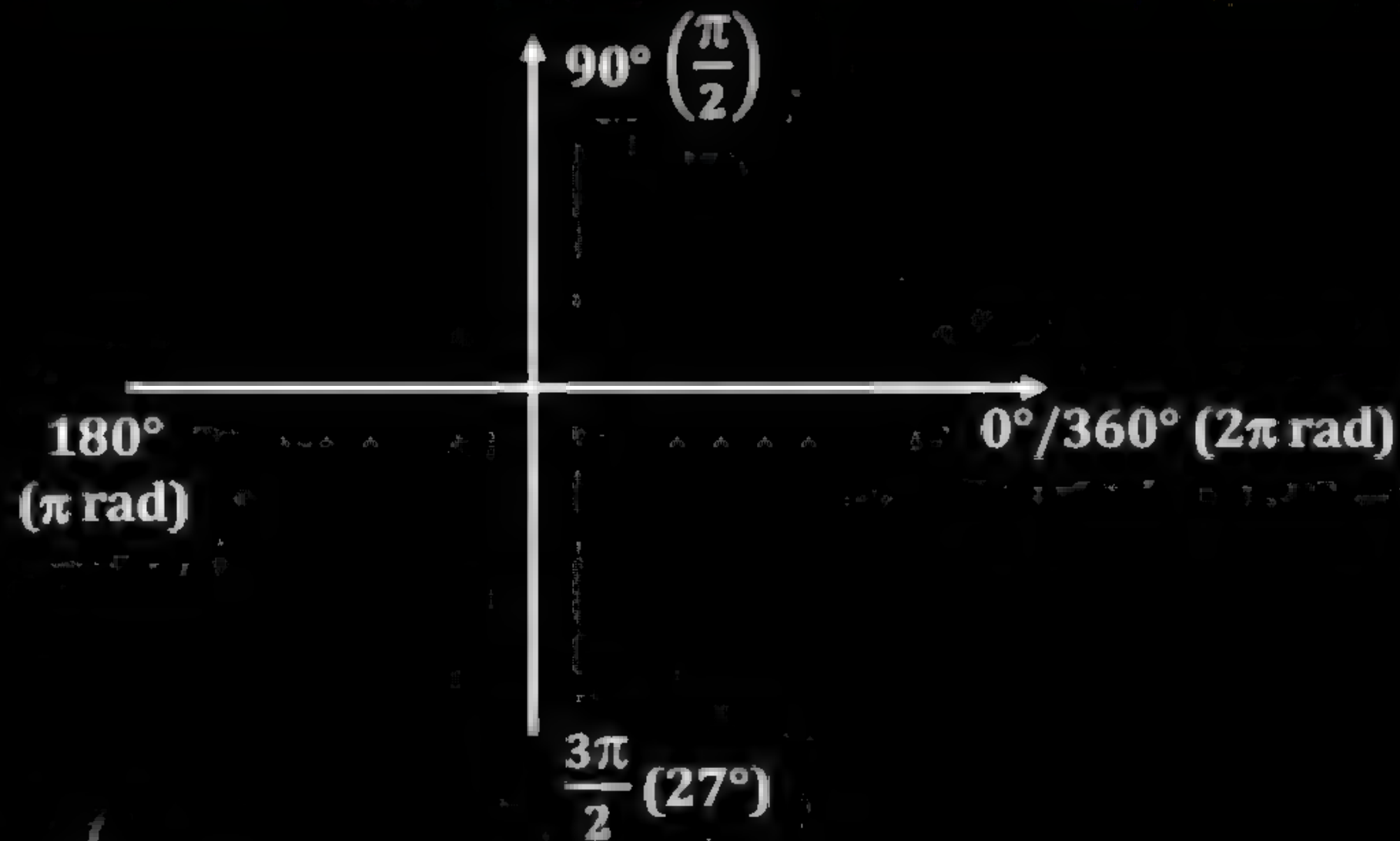


$$\sin(75^\circ) = \sin(45^\circ + 30^\circ) = \checkmark$$

$$\sin(105^\circ) = \sin(60^\circ + 45^\circ) \checkmark$$



TRIGONOMETRY FUNCTION CHARGE



$$\sin (90 - \theta) =$$

$$\cos (90 - \theta) =$$

$$\sin (90 + \theta) =$$

$$\cos (90 + \theta) =$$

$$\sin (180 - \theta) =$$

$$\cos (180 - \theta) =$$



$$\sin (90 - \theta) =$$

$$\cos (90 - \theta) =$$

$$\sin (90 + \theta) =$$

$$\cos (90 + \theta) =$$

$$\sin (180 - \theta) =$$

$$\cos (180 - \theta) =$$





Find value of :

(i) $\sin (-30^\circ)$

(ii) $\cos (-60^\circ)$

(iii) $\sin (120^\circ)$

(iv) $\sin (390^\circ)$

(v) $\sin (20\pi/3)$



If $y = A \sin \theta + B \cos \theta$ then find maximum value of y .



If $y = 3 \sin \theta + 4 \cos \theta$ then find maximum value of y .



If $\frac{A_1}{A_2} = \frac{7}{3}$ then find $\frac{A_1 + A_2}{A_1 - A_2}$



If $\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}} = \frac{5}{3}$ then find $\frac{I_1}{I_2}$.



BINOMIAL APPROXIMATION



$$(1 + x)^2 =$$

$$(1 + x)^n =$$



G.P. SERIES



$$a + ar + ar^2 + ar^3 + \dots$$

Sum = ??



Find sum of 100 term.

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots$$





thanks
for watching

